U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

DOCUMENT RETRIEVAL REQUEST FORM

Requester's Name: Brian Q Le	Case Serial Number:		Art Unit/Org.: 2623
Phone: 30578 5093	Fax:	Building: PK1 4B40	Room Number:
Class/Sub-Class:			
Date of Request: 3/15/04		Date Needed By: Rush	
Paste or add text of citation or bibliography: Paste Citation		Only one request per form. Original copy only.	☐

Author/Editor:	
Journal/Book Title:	
Article Title:	
Volume Number:	Report Number: Pages:
Issue Number:	Series Number: Year of Publication:
Publisher:	
Remarks:	If you need a better copy Please call to let me know. 305-4071

Staff Use Only

Monthly Accession Number:

Library Action	PTO		LC		NAL		NIH		NLM		NIST		Other	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Local Attempts														
Date	3/15													
Initials	KET													
Results	NO													
Examiner Called														
Page Count														
Money Spent														

	Source	Date
Remarks/Comments 1st and 2nd denotes time taken to a library O/N – Under NLM means Overnight	Ordered From:	
	Comments:	

29/3,K/22 (Item 3 from file: 141)
DIALOG(R)File 141:Readers Guide

01532816 H.W. WILSON RECORD NUMBER: BRGA89032816
NASA, McDonnell Douglas test helmet-mounted landing system.
Phillips, Edward H.
Aviation Week & Space Technology (Aviat Week Space Technol) v. 130 (June 19 '89) p. 126-7

...ABSTRACT: a field of view ahead of the aircraft. Information from the cameras is processed and **displayed** on binocular optics installed in an **Integrated Helmet** and **Display Sighting System** (**IHADSS**) developed by Honeywell. The **system** could have applications for current military aircraft in which crew eye protection during combat is...

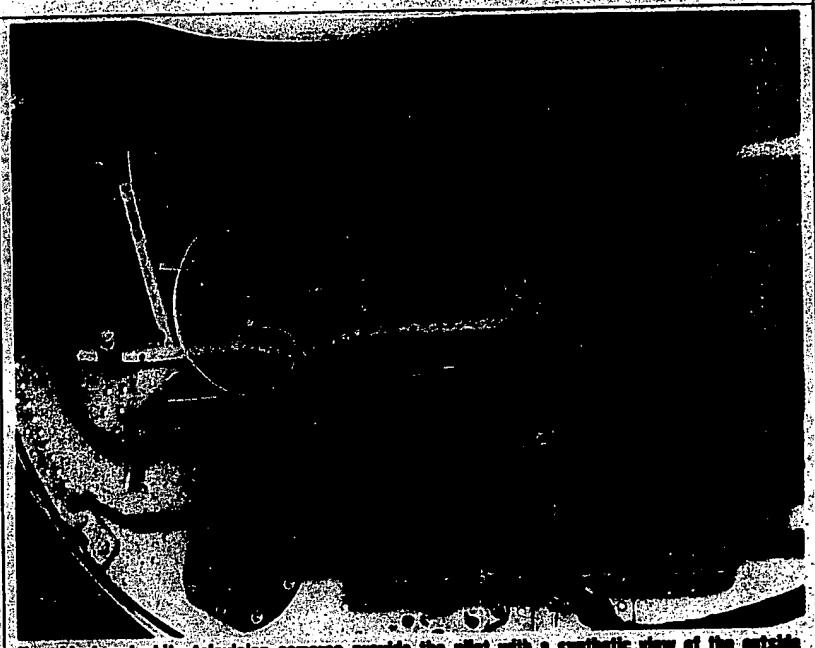
NASA, McDonnell Douglas Test Helmet-Mounted Landing System

EDWARD H. PHILLIPS/HAMPTON, VA.

NASA and McDonnell Douglas are testing a helmet-mounted, visual approach and landing system that could have applications for future aircraft without cockpit windows.

Lee H. Person, engineering flight test pilot at Langley Research Center here, said the experiments are intended to "assess the feasibility of performing safe and accurate manual approaches and landings" using a video camera and helmet-mounted display.

The system could have applications for current military aircraft, in which crew eye protection during combat is important. It also could apply to commercial aircraft with window area restrictions and night vision requirements. NASA said the system also could be used on future hypersonic flight vehicles that may not incorporate conventional cockpit windows.



Two black-and-white television cameras provide the pilot with a synthetic view of the outside world. The cameras, which are boresighted to yield a field of regard of 30 × 80 deg., are depressed 10 deg. to accommodate a normal, 3-deg.-approach glidepath.

OFF-THE-SHELF COMPONENTS

NASA and McDonnell Douglas are participating in the joint flight test program. Flight tests are being conducted using NASA's Boeing 737 Transport Systems Research Vehicle aircraft at Wallops Flight Facility, Va.

Mark S. Rolwes, principal investigator for McDonnell Douglas, said the system consists of off-the-shelf items that would be adequate to demonstrate the feasibility of a "purely electronic visual system."

To provide the pilot with a field of view ahead of the aircraft, two monochrome video cameras are mounted under the weather radar unit in the aircraft's nose. The cameras, which are fixed, are mounted behind an optical plexiglass window in the radome.

Information from the cameras is processed and displayed onto binocular optics installed in an Integrated Helmet and Display Sighting System (IHADSS) developed by Honeywell.

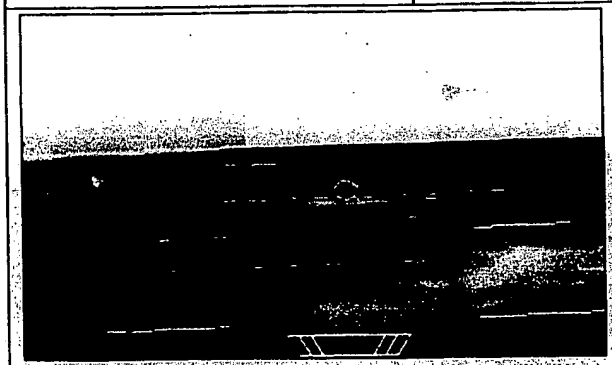
Each camera provides a 30-deg. vertical and 40-deg. horizontal field of view. But each has been skewed about 20 deg. to provide the pilot an 80-deg. horizontal field of regard. The cameras are depressed 10 deg. to facilitate the pilot's view during an approach to landing at a nominal, 3-deg. glidepath angle.

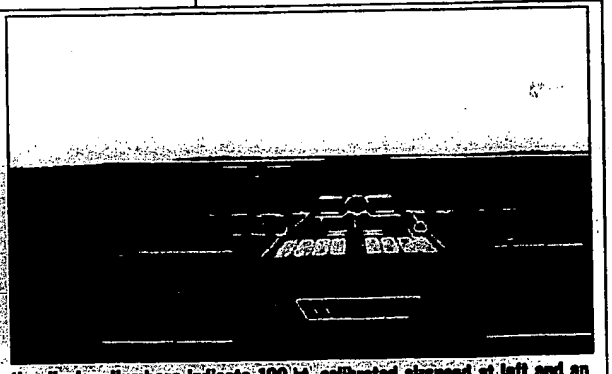
The cameras used for the tests have only 525 lines of resolution. High-resolution cameras capable of more than 1,000 lines would be used if a prototype system is developed.

Resolution is limited in the system's current configuration by the space stabilization unit, which processes video and graphics data and relays the digitized picture to the helmet display. Rolwes said the resolution could be increased if more sophisticated equipment were used.

The use of a fixed sensor suite for the field of view offers advantages, according to Rolwes. He said the system has high reliability because there are no moving parts. The use of multiple sensors provides redundancy and increases the resolution of the field of regard.

A Polhemus magnetic tracking device





In this approach sequence, flight data symbology is shown as it appears on the helmet's binocular optics. The aircraft is on final approach to Runway 22 at Wallops Flight Facility. Flare cue is at center, bottom, of the display. Numbers indicate 129-kt. calibrated airspeed at left and an altitude of 173 ft. About 1/2 mi. from the runway, the flare cue begins to move up toward the velocity vector symbol.

NASA said the system could be used on hypersonic flight vehicles that may not incorporate conventional cockpit windows

NASA test pilot Lee Person is shown wearing the helmet containing binocular viewing optics, which display the image from TV cameras. Symbology is superimposed over the display. The helmet has an integral Polhemus head-tracking unit for sensing where the pilot is looking.

is used to measure the pilot's head movements. When the pilot's head moves, helmet electronics sense where in the field of regard the pilot wants to see. A 30-deg. by 40-deg. instantaneous field of view then is selected, processed and displayed on the eyepieces.

The helmet weighs 4.5 lb. During approach and landing, a dark visor is positioned over the binocular optics to isolate the pilot's view. With the visor up, the instrument panel can be seen clearly.

The large field of view allows the helmet display unit to have a 1:1 magnification of objects—they appear the same size on the display as they do to the camera. There is a 17-millisecond video delay between the time a camera sees an object and the pilot sees it on the display optics. Rolwes said the delay is imperceptible and does not affect pilot performance.

The symbology displayed on the binocular optics is "tailored for use in a transport-class vehicle," according to a McDonnell Douglas official. The graphics are similar to the symbology used on most head-up displays, but have been reduced and simplified to only essential information.

The display is designed for visual approaches only and does not feature instrument landing system or microwave landing system capabilities. Although it is possible to incorporate instrument landing system localizer and glideslope symbology in the optic display field, a NASA official said there are no plans to include such capability at this time.

Aircraft heading, airspeed and altitude are shown along with a velocity vector symbol that indicates flight path angle. At 45 ft. above the runway, a flare cue symbol alerts the pilot to initiate the flare.

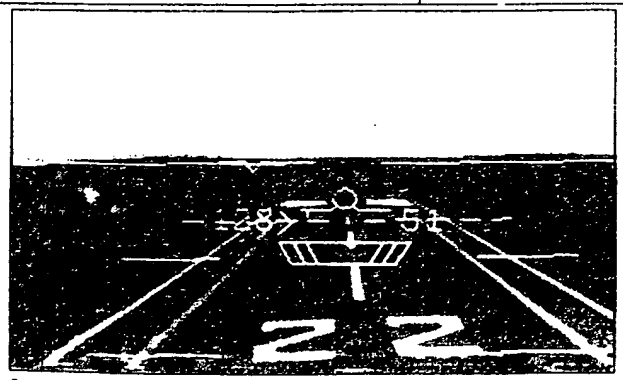
During 23 hr. of flight tests, four pilots have evaluated the system. Two were NASA pilots and two were from McDonnell Douglas. Rolwes said, "We learned a lot about the characteristics of this type of system."

SATISFACTORY RATING

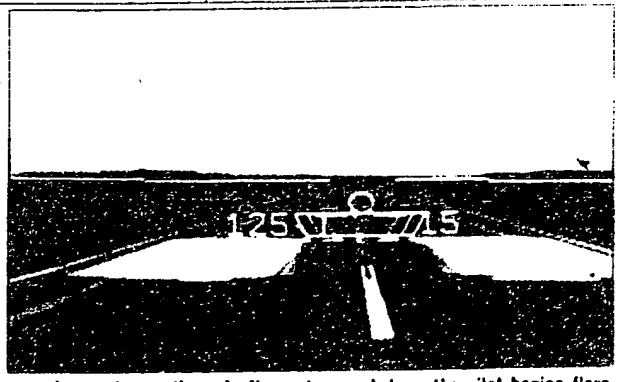
Although the pilots approved of the overall system and found it satisfactory, two wanted the ability to remove unwanted symbology from the display. The pilots said the flare cue symbol was not needed.

A safety pilot, in the left seat, flies the aircraft and establishes it on a 3-5-mi final approach. The pilot wearing the IHADSS then takes control of the aircraft for landing. Person said he was able to land the aircraft within the target area after four or five approaches. Rolwes said all of the pilots landed within 500 ft. of the target after making several practice approaches.

NASA officials, including representatives from the National Aero-Space Plane project office and McDonnell Douglas, plan to evaluate data collected during the flight test program. Rolwes said a second phase of testing, involving more sophisticated equipment and techniques, could be approved in the near future.



Over the runway threshold the flare cue rises toward the velocity vector symbol, which remains over the touchdown zone. Calibrated airspeed is 128 kt. Altitude is 51 ft. Above the touchdown zone, the flare cue is



superimposed over the velocity vector symbol, as the pilot begins flare maneuver to land. Altitude is 15 ft. Pilots who flew the system said the flare cue was not necessary.